Knowledge Clusters and Patented Innovation: Comparative Advantage in Missouri's Economy

Key Findings:

MERIC assessed Michael E Porter's *Clusters of Innovation: Regional Foundations of U.S. Competitiveness* for its applicability to Missouri's economy. Dr. Porter's following points were found to be applicable to Missouri.

- *The most important sources of prosperity are **created** not inherited. Regional development involves some inheritance and serendipity, but also purposeful action.*

- *Productivity does not depend on **what** industries a region competes in, but on **how** it competes. Successful regions build on their unique assets and strong clusters. Such regions leverage their unique mix of assets to build specialized clusters.*

- *The prosperity of a region depends on the productivity of **all** its industries. Regional strategy should encompass a wide range of clusters, and be attentive to clusters that overlap.*

- *Innovation is **vital** for long-term increases in productivity. To meaningfully increase overall regional prosperity, innovative capacity must be built in many clusters. Universities and specialized research centers are the driving force behind innovation in nearly every region.*

Health and business services; securities and commodities brokerage; engineering, accounting and research; and communications are growth industries for Missouri. Transportation equipment manufacture, printing and publishing, and chemicals and allied products manufacture are currently declining, but because they represent a large part of Missouri's metropolitan workforce, efforts to reverse this decline may be warranted.

One argument for reversing the decline in Missouri's transportation equipment manufacturing, printing and publishing and chemicals and allied products manufacturing is that in 1999 Missouri was 30% more concentrated than the national average in transportation equipment manufacturing, 20% more concentrated in printing and publishing, and 59% more concentrated in chemical and allied products production.

Along with food and kindred products (125% more concentrated), leather products (67% more concentrated) and communications (25% more concentrated) these industries represent Missouri's export sector to the rest of the nation. These industries are Missouri's cash crop. Dr. Porter refers to them in his analysis as the traded clusters.

Fostering information sharing in Missouri's export intensive industries could be a way of increasing the state's innovative capacity in overlapping industrial clusters.

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Analysis and Reporting by Timothy O. Smith, Ph.D.

In this report all italicized bullets are direct quotations from *Clusters of Innovation: Regional Foundations of U.S. Competitiveness,* presented by Michael E. Porter at the National Clusters of Innovation Meeting in Washington, D.C., December 13, 2001.

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I. Overview

Geographic comparative advantage is the ability to produce a good or service less expensively, or in a more timely manner than other areas of the country. Geographic comparative advantage is not dependent upon lower wages or cost of living. Silicon Valley has some of the most expensive office space, one of the highest costs of living and some of the most expensive labor in the country, and yet the computer goods and services produced there cannot be produced more inexpensively anywhere else. In *Clusters of Innovation: Regional Foundations of U.S. Competitiveness,* Michael E. Porter presents a specific view of the relationship between innovation, productivity and regional prosperity. Dr. Porter begins with the following four points:

- *The most important sources of prosperity are **created** not inherited.*
- *Productivity does not depend on **what** industries a region competes in, but on **how** it competes.*
- *The prosperity of a region depends on the productivity of **all** its industries.*
- *Innovation is **vital** for long-term increases in productivity.*

The literature supportive of economic growth through deliberate targeting of industries emphasizes that successful programs *must* build on current regional assets and focus on promoting the broadest possible use of intellectual property. The literature critical of the target industries approach points out that public entities almost always over emphasize a few high technology industries and ignore local strength and the overlapping or interacting of industrial clusters. This narrowed focus leads to inefficient spending to attract industries unsuited to the region's unique economic assets.

In light of these caveats, planning to reduce Missouri's unemployment and increase the personal income of Missourians must begin by identifying those industries in which Missouri has a comparative advantage, and identifying Missouri's current advantages or concentrations in innovation.

II. Industrial Specialization in Missouri

In order to aid Missouri's decision makers in identifying areas of economic comparative advantage that they can build upon, and areas of economic vulnerability that they need to strengthen, MERIC analyzed the St. Louis and Kansas City economies using a modified version of Dr. Porter's method. MERIC compared the percentage change in employment in each 2-digit Standard Industrial Classification (SIC) category in the St. Louis and Kansas City regions with the percentage of employment that category represented in each region in 1990. The major difference in method is that Dr. Porter used the percentage of national employment rather than the percentage of regional employment in his analysis.

Figure 1. Specialization of St. Louis Regional Economy

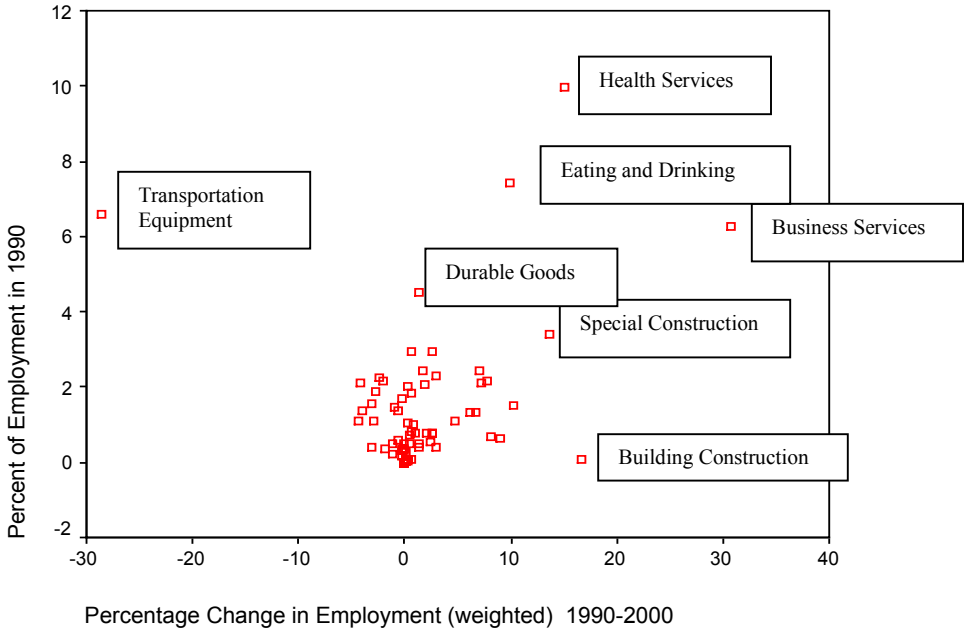

Figure 1 highlights the growth of business services, health services, construction and tourism, and the decline of transportation equipment manufacturing in the St. Louis region.

Figure 2. Specialization of Kansas City Regional Economy

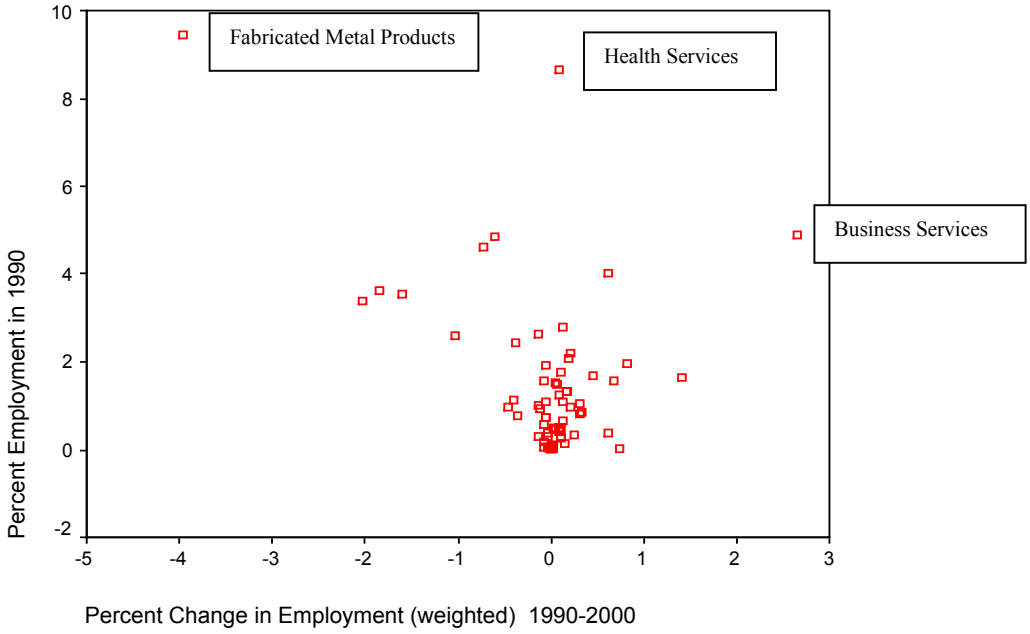

Figure 2 highlights the growth of business services, the importance of health services and the decline of fabricated metal products manufacturing in the Kansas City region.

Health services and business services each represented over 5% of St. Louis and Kansas City regional employment in 1990. Both of these categories show substantial growth in the St. Louis region and business services shows growth in Kansas City between 1990 and 2000. Building construction, special contracts construction, and eating and drinking (tourism) all show substantial growth in the St. Louis region between 1990 and 2000. Durable goods accounts for a large proportion of St. Louis employment, but showed no growth between 1990 and 2000. Transportation equipment manufacture represented over 5% of St. Louis employment and fabricated metal products manufacture represented over 5% of Kansas City employment in 1990. Both categories declined and transportation equipment manufacture declined dramatically between 1990 and 2000.

Table 1: Industries Ranked by Percentage of St. Louis Wage in 1990 and 2000

Rank of Industry by Percent of Total Wage in 1990	Percent of St. Louis Wage	Rank of Industry by Percent of Total Wage in 2000	Percent of St. Louis Wage
Transportation Equipment	10.56%	Health Services	9.71%
Health Services	9.94%	Business Services	6.97%
Wholesale – Durable Goods	6.11%	Transportation Equipment	5.82%
Business Services	4.48%	Wholesale – Durable Goods	5.60%
Construction – Special	3.83%	Construction – Special	4.89%
Chemicals and Allied Products	3.66%	Engineering, Accounting, Research	4.56%
Communications	3.46%	Communications	3.48%
Food and Kindred	3.31%	Chemicals and Allied Products	3.20%
Engineering, Accounting, Research	3.26%	Wholesale - Non-Durable Goods	3.01%
Wholesale – Non-Durable Goods	3.04%	Educational Services	2.84%
Industrial Machinery	2.41%	Food and Kindred	2.69%
Printing and Publishing	2.31%	Security & Commodity Brokers	2.52%
Eating and Drinking	2.29%	Eating and Drinking	2.34%
Educational Services	2.29%	Industrial Machinery	2.33%
Depository Institutions (Banks)	2.05%	Insurance Carriers	1.99%
Insurance Carriers	2.05%	Depository Institutions (Banks)	1.95%
Motor freight transport	1.87%	Transportation by Air	1.84%
Fabricated Metal Products	1.83%	Building Construction	1.80%
Automotive Dealers	1.81%	Automotive Dealers	1.74%
Transportation by Air	1.81%	Printing and Publishing	1.65%

Table 1 ranks industries by the percentage of the total private industry wage represented by each industry in the St. Louis region. The growth of health care, business services, tourism and construction in the St. Louis economy as well as the relative decline of transportation equipment manufacturing are clearly presented by these industry rankings.

Table 2 ranks industries by the percentage of the total private industry wage represented by each industry in the Kansas City region. The dominance of health care and the growth of business services as well as the relative decline of fabricated metal products production are clearly presented by these industry rankings.

Table 2: Industries Ranked by Percentage of Kansas City Wage in 1990 and 2000

Rank of Industry by Percent of Total Wage in 1990	Percent of Kansas City Wage	Rank of Industry by Percent of Total Wage in 2000	Percent of Kansas City Wage
Health Services	10.74%	Health Services	9.63%
Wholesale – Durable Goods	6.56%	Business Services	7.52%
Printing and Publishing	5.04%	Wholesale – Durable Goods	5.57%
Communications	4.62%	Communications	5.22%
Fabricated Metal Products	4.53%	Construction – Special	5.01%
Chemicals and Allied Products	4.02%	Engineering, Accounting & Research	4.27%
Business Services	3.71%	Printing and Publishing	3.79%
Construction – Special	3.64%	Wholesale - Non-Durable Goods	3.08%
Engineering, Accounting & Research	3.14%	Security and Commodity Brokers	2.87%
Transportation by Air	3.11%	Transportation Equipment	2.74%
Wholesale – Non-Durable Goods	3.10%	Eating and Drinking	2.72%
Eating and Drinking	2.78%	Depository Institutions (Banks)	2.64%
Motor Freight and Transportation	2.73%	Fabricated Metal Products	2.61%
Depository Institutions (Banks)	2.71%	Chemicals and Allied Products	2.52%
Insurance Carriers	2.52%	Legal Services	2.30%
Automotive Dealers	2.31%	Insurance Carriers	2.17%
Legal Services	2.10%	Motor Freight and Transportation	2.12%
Transportation Equipment	2.08%	Automotive Dealers	2.11%
Security and Commodity Brokers	1.80%	Amusement and Recreation Services	2.10%
Miscellaneous Retail	1.76%	Electric, Gas and Sanitary Services	1.77%

These growth profiles and industry rankings indicate that health and business services; securities and commodities brokerage; engineering, accounting and research; and communications are growth industries for Missouri. Transportation equipment manufacture, printing and publishing and chemicals and allied products manufacture are currently declining, but they represent industries of such importance to Missouri's metropolitan areas that efforts to understand this decline and reverse it may be warranted.

The MERIC research brief *Economic Diversification and Comparative Advantage: A Report on Gross State Product in 1999* introduced the concept of the Specialization Ratio (SR) which measures how concentrated an industry is in a particular state relative to its concentration in the nation as a whole. Although a state should not become too concentrated in any one industry, this ratio can be regarded as an indication of the market share of an industry cluster that a state has captured for itself. An argument for attempting to reverse the decline in Missouri's transportation equipment manufacturing, printing and publishing and chemicals and allied products manufacturing is that in 1999 Missouri was 30% more concentrated than the national average in transportation equipment manufacturing, 20% more concentrated than the national average in printing and publishing, and 59% more concentrated than the national average in chemical and allied products production. Along with food and kindred products (125% greater), leather products (67% greater) and communications (25% greater) these industries represent Missouri's export sector to the rest of the nation. These industries are Missouri's cash crop. Dr. Porter refers to them in his analysis as the traded clusters.

Dr. Porter's analysis of clusters to regional economic growth emphasizes the importance of overlapping and interacting clusters for sustainable, broadly based growth. Growth of business services may be part of the reason for the growth in the securities brokerage and the accounting and research sectors. The dominance of health services and the growth of research may indicate that encouraging the formation of life sciences research and production could help restore chemical and allied products manufacture in Missouri.

Dr. Porter draws the following implications from his generalized analysis of clusters:

- *Successful regions build on their unique assets and strong clusters.*
- *Focus on a few clusters exposes a regional economy to the booms and busts.*
- *Regional strategy should encompass a wide range of clusters, and be attentive to clusters that overlap.*
- *To meaningfully increase overall regional prosperity, innovative capacity must be built in many clusters.*

An example of building on a unique combination of seemingly unrelated regional clusters would be a conference between the meat packing industry (food and related products), leather products industry, and the chemicals industry. Could a simple difference in the handling of hides, a by-product of meat packing, reduce the cost of leather production? The meat packers probably do not know the answer to this, but the leather producers and leather working chemical producers probably do. The handling of hides may be so minor a concern to meat packers that sponsoring such a conference would not enter their consideration, and the leather producers may not be able to do so independently. Fostering such information sharing in Missouri's export intensive industries could be a way of increasing the state's innovative capacity in overlapping industrial clusters.

The suggestion of inter-industry collaboration presented by the regional specialization and industry ranking data is further reinforced by the patent issuance data for Missouri between 1995 and 1999.

III. Patent Innovation by Industry and Area in Missouri

Dr. Porter highlights the importance of inter-industry collaboration and the strategic use of a region's unique economic assets as follows:

- *Institutions for collaboration play an important role in building regional economies.*
- *Regional development involves some inheritance and serendipity, but also purposeful action.*
- *Successful regions leverage their unique mix of assets to build specialized clusters.*
- *Universities and specialized research centers are the driving force behind innovation in nearly every region.*

Both Kansas City and St. Louis produce technological innovation at well below the

national average. In 1998 Kansas City produced 13.8 patents per 100,000 population, and St. Louis produced 29.0 per 100,000. This rate is in comparison with a national average of 34.6 per 100,000 in metropolitan areas in 1998. In 1999 Kansas City produced 15.8 patents per 100,000 population and St. Louis produced 28.9 per 100,000. This rate is in comparison with a national average of 35.8 per 100,000 in metropolitan areas in 1999.

Tables 3 through 8 address the questions: who originated the most patents in Missouri between 1995 and 1999 and in what subject areas (patent classes) were those patents originated.

The highlighted text in Tables 4 and 6 show concentrations of different subjects of innovation between Kansas City and St. Louis. Life science innovation (surgery, drug production and other organic chemical production) seems to be important in both cities. St. Louis innovates further in materials packaging and fluid dispensing, spraying and purifying. Kansas City on the other had innovates further in communications equipment production and chemical solvents for cleaning, and adhesive bonding. Each city also further specializes in different subject areas of innovation as indicated in the tables. The important fact to gather from these tables is the great diversity of innovation taking place in St. Louis and Kansas City even though the amount of innovation still falls below the national average.

List of Tables:

U.S. Patents Held in the St Louis Region:

The number of patents originating in an area, who holds those patents and in what fields are also measures of innovation and innovation clustering. Tables 3 and 4 provide the detail for the originators of the largest number of patents between 1995 and 1999 in the St. Louis area, and for the subject classifications in which those patents were granted.

Table 3. Top 20 Originators of Patents from 1995 through 1999 in the St. Louis Metropolitan Area

St. Louis, MO-IL MSA	1995	1996	1997	1998	1999	-- Total --	SIC Name
~Individually Owned Patent	108	102	134	145	153	**641**	
SOUTHPAC TRUST INTERNATIONAL, INC.	0	31	118	86	58	**293**	
MONSANTO COMPANY, INC.	60	57	66	55	52	**290**	Pesticides and Agricultural Chemicals
MCDONNELL DOUGLAS CORP.	9	19	19	40	54	**141**	Aircraft
WASHINGTON UNIVERSITY	21	16	20	38	45	**140**	Colleges, Universities and Professional Schools
EMERSON ELECTRIC CO.	17	27	25	32	31	**132**	Motors and Generators
G. D. SEARLE & CO.	17	20	35	25	28	**125**	Manmade Organic Fibers, Except Cellulosic
MALLINCKRODT MEDICAL, INC.	21	16	25	10	1	**73**	Medical Chemicals and Botanical Products
HIGHLAND SUPPLY CORPORATION	36	23	1	0	0	**60**	
MEMC ELECTRONIC MATERIALS, INC.	2	8	10	20	18	**58**	Semiconductors and Related Devices
CONTICO INTERNATIONAL, INC.	4	16	15	15	0	**50**	Plastic Products
SHERWOOD MEDICAL COMPANY	13	7	4	5	0	**29**	Surgical and Medical Instruments and Apparatus
BIOMERIEUX VITEK, INC.	0	0	3	12	12	**27**	Surgical and Medical Instruments and Apparatus
HUNTER ENGINEERING COMPANY	7	8	3	3	5	**26**	Special Industry Machinery
SOLUTIA INC.	0	0	0	6	14	**20**	Industrial Organic Chemicals
THE FAMILY TRUST U/TA	0	20	0	0	0	**20**	
COIN ACCEPTORS, INC.	1	5	4	4	4	**18**	Automatic Vending Machines
CONTINENTAL SPRAYERS INTERNATIONAL, INC.	0	0	0	7	10	**17**	Plastic Products
SOUTHWESTERN BELL TECHNOLOGY RESOURCES, INC.	4	3	6	3	1	**17**	Telephone Communications, Except Radiotelephone
ST. LOUIS UNIVERSITY	1	1	2	3	10	**17**	Colleges, Universities and Professional Schools
NOVUS INTERNATIONAL, INC.	0	2	3	2	9	**16**	Farm Supplies

Table 4. Patent Classes in Which 25 or More Patents were Originated between 1995 and 1999 in the St. Louis Metro Area

St. Louis, MO-IL MSA						
U.S. Patent Class and Description	1995	1996	1997	1998	1999	Total
Class 053 , Package Making	25	34	68	52	30	**209**
Class 514 , Drug, Bio-Affecting and Body Treating Compositions	29	25	49	57	36	**196**
Class 424 , Drug, Bio-Affecting and Body Treating Compositions	26	20	37	20	32	**135**
Class 435 , Chemistry: Molecular Biology and Microbiology	13	15	19	32	28	**107**
Class 428 , Stock Material or Miscellaneous Articles	15	4	31	19	17	**86**
Class 206 , Special Receptacle or Package	9	11	16	21	16	**73**
Class 222 , Dispensing	10	9	7	22	12	**60**
Class 047 , Plant Husbandry	6	20	12	10	10	**58**
Class 310 , Electrical Generator or Motor Structure	3	7	12	19	16	**57**
Class 606 , Surgery	13	6	7	7	16	**49**
Class 029 , Metal Working	4	12	9	12	9	**46**
Class 800 , Multicellular Living Organisms and Unmodified Parts Thereof and Related Processes	3	10	12	10	7	**42**
Class 504 , Plant Protecting and Regulating Compositions	6	8	11	8	6	**39**
Class 604 , Surgery	16	5	7	4	5	**37**
Class 248 , Supports	5	5	7	9	10	**36**
Class 005 , Beds	4	10	9	6	4	**33**
Class 530 , Chemistry: Natural Resins or Derivatives; Peptides or Proteins; Lignins or Reaction Products Thereof	8	2	2	9	11	**32**
Class 052 , Static Structures (e.g., Buildings)	3	7	3	5	13	**31**
Class 239 , Fluid Sprinkling, Spraying, and Diffusing	2	7	10	6	6	**31**
Class 600 , Surgery	3	4	8	9	7	**31**
Class 073 , Measuring and Testing	9	4	8	5	4	**30**
Class 137 , Fluid Handling	5	5	4	5	9	**28**
Class 548 , Organic Compounds -- Part of the Class 532-570 Series	3	9	4	0	12	**28**
Class 340 , Communications: Electrical	5	7	5	3	7	**27**
Class 128 , Surgery	4	6	6	6	4	**26**
Class 210 , Liquid Purification or Separation	4	6	5	4	7	**26**
Class 422 , Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing	0	1	3	13	9	**26**

Materials packaging Life sciences (surgery, drug production and bio-chemistry) Fluid handling and dispensing

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Table 5. Top 20 Originators of Patents from 1995 through 1999 in the Kansas City Metropolitan Area

Kansas City, MO-KS MSA	1995	1996	1997	1998	1999	-- Total --	
~Individually Owned Patent	55	57	62	77	98	349	
BAYER CORPORATION	2	6	0	7	16	31	Chemicals and Allied Products
SPRINT COMMUNICATIONS COMPANY L.P.	1	3	1	11	8	24	Communications Equipment
ALLIED-SIGNAL INC.	6	4	4	3	3	20	Ammunition, Except for Small Arms
NELLCOR PURITAN BENNETT INCORPORATED	0	1	2	8	6	17	Medical, Dental and Hospital Equipment
GARMIN CORPORATION	0	1	4	1	6	12	
MIDLAND BRAKE, INC.	6	2	1	3	0	12	Motor Vehicle Parts and Accessories
DIAMANT BOART, INC.	2	2	2	4	0	10	Power Driven Handtools
BHA GROUP HOLDINGS, INC.	0	0	2	5	2	9	Industrial Fans and Air Purification Equipment
PURITAN-BENNETT CORPORATION	2	2	2	2	1	9	Surgical and Medical Instruments and Apparatus
TENSION ENVELOPE CORPORATION	4	2	1	0	2	9	Envelopes
WEST AGRO, INC.	2	1	3	1	2	9	Industrial Inorganic Chemicals
HARMON INDUSTRIES, INC.	2	3	2	0	1	8	Communications Equipment
HOECHST MARION ROUSSEL, INC.	0	3	2	1	2	8	
TOMKINS INDUSTRIES, INC.	1	1	2	3	1	8	
PRECO INDUSTRIES, LTD.	0	1	1	3	2	7	
SEALRIGHT CO., INC.	0	3	3	0	1	7	Sanitary Food Containers
AGCO CORPORATION	1	0	1	1	3	6	Farm Machinery and Equipment
ALFA-LAVAL AGRI, INC.	0	3	2	1	0	6	Farm and Garden Machinery and Equipment
SCRIPTPRO L.L.C.	0	0	0	3	3	6	
V-LITE CORPORATION	2	4	0	0	0	6	

Table 6. Patent Classes in Which 10 or More Patents were Originated between 1995 and 1999 in the Kansas City Metro Area

Kansas City, MO-KS MSA	1995	1996	1997	1998	1999	Total
Class 128 , Surgery	1	7	4	11	6	**29**
Class 379 , Telephonic Communications	3	2	5	8	5	**23**
Class 052 , Static Structures (e.g., Buildings)	5	6	2	3	6	**22**
Class 424 , Drug, Bio-Affecting and Body Treating Compositions	4	1	5	3	9	**22**
Class 600 , Surgery	3	6	3	2	7	**21**
Class 606 , Surgery	2	3	4	7	5	**21**
Class 342 , Communications: Directive Radio Wave Systems and Devices (e.g., Radar, Radio Navigation)	3	8	6	1	1	**19**
Class 514 , Drug, Bio-Affecting and Body Treating Compositions	1	5	2	4	7	**19**
Class 156 , Adhesive Bonding and Miscellaneous Chemical Manufacture	1	3	3	7	1	**15**
Class 340 , Communications: Electrical	1	2	3	5	4	**15**
Class 134 , Cleaning and Liquid Contact with Solids	1	2	3	3	4	**13**
Class 435 , Chemistry: Molecular Biology and Microbiology	1	5	3	3	1	**13**
Class 073 , Measuring and Testing	2	2	5	1	2	**12**
Class 303 , Fluid-Pressure and Analogous Brake Systems	6	2	1	3	0	**12**
Class 558 , Organic Compounds -- Part of the Class 532-570 Series	2	3	0	1	6	**12**
Class 206 , Special Receptacle or Package	3	1	2	3	2	**11**
Class 248 , Supports	2	1	1	3	4	**11**
Class 426 , Food or Edible Material: Processes, Compositions, and Products	2	0	2	2	5	**11**
Class 452 , Butchering	2	2	2	2	3	**11**
Class 548 , Organic Compounds -- Part of the Class 532-570 Series	1	0	1	2	7	**11**
Class 004 , Baths, Closets, Sinks, and Spittoons	0	0	3	5	2	**10**
Class 015 , Brushing, Scrubbing, and General Cleaning	3	1	0	2	4	**10**
Class 040 , Card, Picture, or Sign Exhibiting	1	1	3	2	3	**10**
Class 043 , Fishing, Trapping, and Vermin Destroying	1	2	2	1	4	**10**
Class 119 , Animal Husbandry	0	4	3	2	1	**10**
Class 137 , Fluid Handling	3	3	1	2	1	**10**
Class 210 , Liquid Purification or Separation	1	2	3	1	3	**10**
Class 356 , Optics: Measuring and Testing	2	2	2	2	2	**10**
Class 428 , Stock Material or Miscellaneous Articles	1	1	1	5	2	**10**
Class 604 , Surgery	2	2	1	3	2	**10**

Communications equipment Life sciences (surgery, drug production and bio-chemistry) Adhesive and cleaning chemicals production

Table 7. Originators of 5 or More Patents from 1995 through 1999 in Non-Urban Missouri

	1995	1996	1997	1998	1999	Total	
Springfield, MO MSA							
Individually Owned Patents	12	12	16	16	15	**71**	
DAYCO PRODUCTS, INC.	11	7	3	3	1	**25**	Rubber and Plastic Hose and Belting
CUSTOM METALCRAFT, INC.	2	2	2	1	2	**9**	Fabricated Metal Plate Work
STAMINA PRODUCTS, INC.	2	0	0	2	2	**6**	Sporting and Recreational Goods and Supplies
WESTERN LITHO PLATE + SUPPLY CO.	0	1	2	0	2	**5**	Print Plate Making and Related Services
Columbia, MO MSA							
Individually Owned Patents	3	4	8	3	7	**25**	
CURATORS OF THE UNIVERSITY OF MISSOURI	5	6	11	11	11	**44**	University – General and Surgical Hospital
HUBBELL INCORPORATED	4	2	5	2	0	**13**	Non-current Carrying Wiring Devices
TOASTMASTER, INC.	3	0	2	0	1	**6**	Electric Housewares and Fans
St. Joseph, MO MSA							
Individually Owned Patents	2	2	1	1	2	**8**	
HERZOG CONTRACTING CORPORATION	2	2	1	0	0	**5**	Highway and Street Construction
NESTEC, S.A.	1	2	0	1	1	**5**	
Joplin, MO MSA							
Individually Owned Patents	2	5	4	3	3	**17**	
L&P PROPERTY MANAGEMENT COMPANY	3	7	10	9	8	**37**	
SUNBEAM PRODUCTS, INC.	0	1	1	2	1	**5**	Household Cooking Equipment
_Non-Metropolitan Areas, MISSOURI							
Individually Owned Patents	37	41	37	65	43	**222**	
CURATORS OF THE UNIVERSITY OF MISSOURI	1	1	3	2	4	**11**	University – General and Surgical Hospital
ABB POWER T&D COMPANY INC.	1	1	2	2	3	**9**	Power, Distribution, and Specialty Transformers
BREWER SCIENCE, INC.	1	0	2	1	3	**7**	Plastic Materials and Synthetic Resins
DAYCO PRODUCTS, INC.	3	2	2	0	0	**7**	Rubber and Plastic Hose and Belting
HAWKER ENERGY PRODUCTS, INC.	2	0	3	1	0	**6**	Storage Battery Manufacture
HUBBELL INCORPORATED	1	1	3	1	0	**6**	Non-current Carrying Wiring Devices
DURA AUTOMOTIVE SYSTEMS, INC.	1	0	1	1	2	**5**	Motor Vehicle Parts and Accessories
ELISHA TECHNOLOGIES CO. L.L.C.	0	0	0	1	4	**5**	Commercial Physical and Biological Research
ORSCHELN CO.	1	2	1	1	0	**5**	Motor Vehicle Parts and Accessories

Table 8. Patent Classes in Which 3 or More Patents were Originated between 1995 and 1999 in Non-Urban Missouri

Springfield, MO MSA	1995	1996	1997	1998	1999	Total
Class 280 , Land Vehicles	3	4	3	1	1	**12**
Class 141 , Fluent Material Handling, with Receiver or Receiver Coacting Means	2	1	2	3	2	**10**
Class 474 , Endless Belt Power Transmission Systems or Components	4	4	0	0	0	**8**
Class 482 , Exercise Devices	3	0	0	3	2	**8**
Class 220 , Receptacles	1	2	1	1	1	**6**
Class 248 , Supports	1	0	3	2	0	**6**
Class 114 , Ships	0	1	2	1	0	**4**
Class 285 , Pipe Joints or Couplings	2	1	0	1	0	**4**
Class 072 , Metal Deforming	0	2	1	0	0	**3**
Class 156 , Adhesive Bonding and Miscellaneous Chemical Manufacture	2	0	1	0	0	**3**
Class 206 , Special Receptacle or Package	0	1	1	0	1	**3**
Class 355 , Photocopying	0	0	2	0	1	**3**
Class 403 , Joints and Connections	0	0	0	3	0	**3**
Class 602 , Surgery: Splint, Brace, or Bandage	0	1	0	0	2	**3**
Class 707 , Data Processing: Database and File Management, Data Structures, or Document Processing	0	0	0	2	1	**3**
Columbia, MO MSA	1995	1996	1997	1998	1999	Total
Class 514 , Drug, Bio-Affecting and Body Treating Compositions	0	2	2	3	3	**10**
Class 435 , Chemistry: Molecular Biology and Microbiology	2	1	3	3	0	**9**
Class 424 , Drug, Bio-Affecting and Body Treating Compositions	0	0	2	1	4	**7**
Class 604 , Surgery	1	4	1	0	1	**7**
Class 536 , Organic Compounds -- Part of the Class 532-570 Series	0	0	2	3	1	**6**
Class 099 , Foods and Beverages: Apparatus	2	0	2	0	1	**5**
Class 210 , Liquid Purification or Separation	1	0	0	2	1	**4**
Class 324 , Electricity: Measuring and Testing	0	0	3	1	0	**4**
Class 439 , Electrical Connectors	0	0	1	2	1	**4**
Class 052 , Static Structures (e.g., Buildings)	1	1	1	0	0	**3**
Class 074 , Machine Element or Mechanism	3	0	0	0	0	**3**
Class 137 , Fluid Handling	0	0	2	1	0	**3**

St. Joseph, MO MSA	1995	1996	1997	1998	1999	Total
Class 015 , Brushing, Scrubbing, and General Cleaning	0	0	0	0	3	**3**
Class 182 , Fire Escape, Ladder, or Scaffold	0	0	1	0	2	**3**
Class 426 , Food or Edible Material: Processes, Compositions, and Products	0	1	0	1	1	**3**
Joplin, MO MSA	1995	1996	1997	1998	1999	Total
Class 005 , Beds	3	4	7	4	3	**21**
Class 126 , Stoves and Furnaces	1	2	1	0	1	**5**
Class 210 , Liquid Purification or Separation	0	1	3	0	0	**4**
Class 267 , Spring Devices	0	1	1	1	1	**4**
Class 606 , Surgery	0	2	0	2	0	**4**
Class 052 , Static Structures (e.g., Buildings)	1	0	0	1	1	**3**
Class 140 , Wireworking	0	0	0	2	1	**3**
Non-Metropolitan Areas, MISSOURI	1995	1996	1997	1998	1999	Total
Class 114 , Ships	4	1	2	3	1	**11**
Class 043 , Fishing, Trapping, and Vermin Destroying	0	1	2	2	5	**10**
Class 062 , Refrigeration	1	0	4	4	1	**10**
Class 029 , Metal Working	3	2	0	2	2	**9**
Class 222 , Dispensing	3	1	1	1	3	**9**
Class 285 , Pipe Joints or Couplings	3	3	3	0	0	**9**
Class 428 , Stock Material or Miscellaneous Articles	2	4	1	0	2	**9**
Class 248 , Supports	2	1	2	2	0	**7**
Class 340 , Communications: Electrical	1	0	2	2	2	**7**
Class 405 , Hydraulic and Earth Engineering	3	2	1	2	0	**7**
Class 800 , Multicellular Living Organisms and Unmodified Parts Thereof and Related Processes	0	0	0	5	2	**7**
Class 052 , Static Structures (e.g., Buildings)	1	4	1	0	1	**6**
Class 188 , Brakes	2	1	1	1	1	**6**
Class 252 , Compositions	0	0	3	1	2	**6**
Class 280 , Land Vehicles	0	3	0	1	2	**6**
Class 402 , Binder Device Releasably Engaging Aperture or Notch of Sheet	1	0	3	2	0	**6**
Class 429 , Chemistry: Electrical Current Producing Apparatus, Product, and Process	2	0	3	1	0	**6**
Class 430 , Radiation Imagery Chemistry: Process, Composition, or Product Thereof	1	0	1	1	3	**6**

Non-Metropolitan Areas, MISSOURI continued						
	1995	1996	1997	1998	1999	**Total**
Class 606 , Surgery	0	1	2	1	2	**6**
Class 074 , Machine Element or Mechanism	1	1	1	0	2	**5**
Class 119 , Animal Husbandry	1	1	0	2	1	**5**
Class 128 , Surgery	3	0	0	2	0	**5**
Class 156 , Adhesive Bonding and Miscellaneous Chemical Manufacture	1	0	0	2	2	**5**
Class 210 , Liquid Purification or Separation	0	1	1	1	2	**5**
Class 297 , Chairs and Seats	1	1	1	2	0	**5**
Class 427 , Coating Processes	0	2	1	0	2	**5**
Class 433 , Dentistry	0	0	1	1	3	**5**
Class 482 , Exercise Devices	1	0	0	2	2	**5**
Class 054 , Harness	3	0	0	1	0	**4**
Class 072 , Metal Deforming	1	0	0	2	1	**4**
Class 124 , Mechanical Guns and Projectors	1	1	1	1	0	**4**
Class 182 , Fire Escape, Ladder, or Scaffold	1	1	0	1	1	**4**
Class 206 , Special Receptacle or Package	0	1	1	1	1	**4**
Class 209 , Classifying, Separating, and Assorting Solids	1	2	0	0	1	**4**
Class 414 , Material or Article Handling	1	0	1	0	2	**4**
Class 004 , Baths, Closets, Sinks, and Spittoons	0	2	0	0	1	**3**
Class 056 , Harvesters	0	0	0	1	2	**3**
Class 070 , Locks	0	0	0	1	2	**3**
Class 192 , Clutches and Power-Stop Control	1	0	1	1	0	**3**
Class 211 , Supports: Racks	0	1	0	2	0	**3**
Class 219 , Electric Heating	0	0	0	1	2	**3**
Class 227 , Elongated-Member-Driving Apparatus	0	0	0	0	3	**3**
Class 242 , Winding, Tensioning, or Guiding	2	0	1	0	0	**3**
Class 330 , Amplifiers	0	1	1	1	0	**3**
Class 403 , Joints and Connections	0	1	0	2	0	**3**
Class 410 , Freight Accommodation On Freight Carrier	1	2	0	0	0	**3**
Class 422 , Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing	0	1	0	1	1	**3**
Class 439 , Electrical Connectors	0	0	1	0	2	**3**
Class 452 , Butchering	0	0	2	0	1	**3**
Class 463 , Amusement Devices: Games	0	0	0	3	0	**3**
Class 600 , Surgery	0	1	0	1	1	**3**

IV. Conclusion

Michael Porter's analysis of the importance of industrial clusters to regional growth suggests the following points for Missouri's economic policy makers:

- *The most important sources of prosperity are **created** not inherited. Regional development involves some inheritance and serendipity, but also purposeful action.*

- *Productivity does not depend on **what** industries a region competes in, but on **how** it competes. Successful regions build on their unique assets and strong clusters. Such regions leverage their unique mix of assets to build specialized clusters.*

- *The prosperity of a region depends on the productivity of **all** its industries. Regional strategy should encompass a wide range of clusters, and be attentive to clusters that overlap.*

- *Innovation is **vital** for long-term increases in productivity. To meaningfully increase overall regional prosperity, innovative capacity must be built in many clusters. Universities and specialized research centers are the driving force behind innovation in nearly every region.*

Health and business services; securities and commodities brokerage; engineering, accounting and research; and communications are growth industries for Missouri. Transportation equipment manufacture, printing and publishing, and chemicals and allied products manufacture are currently declining, but because they represent a large part of Missouri's metropolitan workforce, efforts to reverse this decline may be warranted.

One argument for reversing the decline in Missouri's transportation equipment manufacturing, printing and publishing and chemicals and allied products manufacturing is that in 1999 Missouri was 30% more concentrated than the national average in transportation equipment manufacturing, 20% more concentrated in printing and publishing, and 59% more concentrated in chemical and allied products production.

Along with food and kindred products (125% more concentrated), leather products (67% more concentrated) and communications (25% more concentrated) these industries represent Missouri's export sector to the rest of the nation. These industries are Missouri's cash crop. Dr. Porter refers to them in his analysis as the traded clusters.

Fostering information sharing in Missouri's export intensive industries could be a way of increasing the state's innovative capacity in overlapping industrial clusters.